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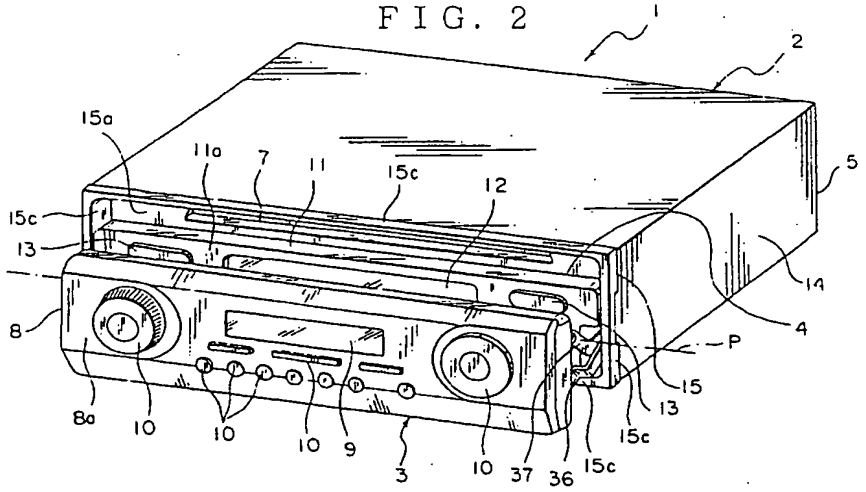
(54) Driving mechanism of electronic instrument

(57) The electronic instrument has an instrument body (2) formed with a recording medium inserting slot (7) for inserting a recording medium into the instrument body (2). The driving mechanism moves a first operation unit (4) and a second operation unit (3) between a first position for covering the recording medium inserting slot (7) and a second position for exposing the recording medium inserting slot (7). The driving mechanism includes a first turnable supporting member turnably fitted to the instrument body (2) for supporting the first operation unit (4), a first drive device for turning the first turnable supporting member, a second supporting member (36) for supporting the second operation unit (3), a second turnable supporting member (37) turnably fitted to the instrument body for supporting the second operation unit (3), and a second drive device for turning the second turnable supporting member. The second drive device supports the second supporting member movably in directions along which the recording medium is inserted and removed through the recording medium inserting slot (7) of the instrument body (2). The first drive device turns the first turnable supporting member to move the first operation unit between the first position and the second position. The second drive device moves the second supporting member and turns the second turnable supporting member to move the second operation unit between the first position and the second position.

FIG. 2



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to provide a driving mechanism which allows a sufficient recognition of an operation status of the instrument.

[0016] For achieving the first object of the invention, a driving mechanism of a first aspect of the present invention is a driving mechanism of an electronic instrument having an instrument body formed with a recording medium inserting slot for inserting a recording medium into the instrument body, the driving mechanism moving a first operation unit between a first position for covering the recording medium inserting slot and a second position for exposing the recording medium inserting slot, the driving mechanism comprising:

a supporting member extended from the first operation unit into the instrument body,.
a guide portion mounted in the instrument body for guiding the first operation unit via the supporting member to move the first operation unit between the first position and the second position, the guide portion movably receiving an end of the supporting member, and
a first drive device for moving the supporting member along the guide portion.

[0017] A second aspect of the present invention is the driving mechanism according to the first aspect. The driving mechanism further comprises a first turnable supporting member turnably fitted to the instrument body for supporting the first operation unit wherein the first drive device turns the first turnable supporting member to move the first operation unit between the first position and the second position.

[0018] A third second aspect of the present invention is the driving mechanism according to the second aspect. The first drive device includes:

a first projecting piece projecting from the first turnable supporting member,
a gear turned by a drive motor and formed with a first groove, and
a guide hole through which the first projecting piece passes such that the first projecting piece is received in the first groove,

wherein the gear turns so that the first groove moves the first projecting piece along the first guide hole to move the first operation unit between the first position and the second position.

[0019] For achieving the second object of the invention, a fourth aspect of the present invention is a driving mechanism of an electronic instrument having an instrument body formed with a recording medium inserting slot for inserting a recording medium into the instrument body, the driving mechanism moving a second operation unit between a first position for covering the recording medium inserting slot and a second position for exposing the recording medium inserting slot, the driving mechanism comprising:

a second supporting member for supporting the second operation unit,
a second turnable supporting member turnably fitted to the instrument body for supporting the second operation unit, and
a second drive device for turning the second turnable supporting member, the second drive device supporting the second supporting member movably in directions along which the recording medium is inserted and removed,

wherein the second drive device moves the second supporting member and turns the second turnable supporting member to move the second operation unit between the first position and the second position.

[0020] A fifth aspect of the present invention is the driving mechanism according to the fourth aspect. The second drive device includes:

a second projecting piece projecting from the second supporting member,
a third projecting piece projecting from the second turnable supporting member,
a gear turned by a drive motor, the gear formed with a second groove and a third groove,
a second guide hole through which the second projecting piece passes such that the second projecting piece is received in the second groove, and
a third guide hole through which the third projecting piece passes such that the third projecting piece is received in the third groove,

wherein the gear turns so that the second groove moves the second projecting piece along the second guide hole and the third groove moves the third projecting piece along the third guide hole to move the second operation unit between the first position and the second position.

[0021] For achieving the second object of the invention, a sixth aspect of the present invention is a driving mechanism of an electronic instrument having an instrument body formed with a recording medium inserting slot for inserting a recording medium into the instrument body, the driving mechanism moving a first operation unit and a second operation unit between a first position for covering the recording medium inserting slot and a second position for exposing the recording medium inserting slot, the driving mechanism comprising:

a first turnable supporting member turnably fitted to the instrument body for supporting the first operation unit,
a first drive device for turning the first turnable supporting member,
a second supporting member for supporting the second operation unit,
a second turnable supporting member turnably fitted to the instrument body for supporting the second

can be moved by the single gear. This can reduce the instrument in number of parts and in manufacturing cost thereof. The simple configuration of the single gear can move the two operation units between first position and the second position. Since the two operation units are exposed for the user. the display panel can be arranged on both the operation units in addition to the surface of the instrument body, allowing a broader display area. Thus, the user can visually recognize information on the display panels so as to know well an operation status of the electronic instrument.

[0031] In the seventh aspect of the present invention, the two operation units associated with the instrument body can be moved by the single gear. This can reduce the instrument in number of parts and in manufacturing cost thereof. The simple configuration of the single gear can move the two operation units between first position and the second position. Since the two operation units are exposed for the user, the display panel can be arranged on both the operation units in addition to the surface of the instrument body, allowing a broader display area. Thus, the user can visually recognize information on the display panels so as- to know well an operation status of the electronic instrument.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032]

FIG. 1 is a perspective view showing an electronic instrument having a driving mechanism according to an embodiment of the present invention;
FIG. 2 is a perspective view showing the electronic instrument of FIG. 1, in which a first operation unit and a second operation unit have moved to the second position;
FIG. 3 is a perspective view showing the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the third position;
FIG. 4 is an exploded perspective view showing a first driving unit of the driving mechanism of FIG. 1;
FIG. 5 is an exploded perspective view showing a second driving unit of the driving mechanism of FIG. 1;
FIG. 6 is a front view showing the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the first position;
FIG. 7 is a side view partially in section showing the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the first position;
FIG. 8 is a perspective view showing the electronic instrument of FIG. 1, in which a first holder and a second holder have moved to the first position;
FIG. 9 is a side view taken along arrow A of FIG. 8 to show a second frame and a cam gear with the relative positions thereof;
FIG. 10 is a side view taken along arrow A of FIG. 8 to show the second frame, a second arm, and a third arm with the relative positions thereof;
FIG. 11 is a side view taken along arrow B of FIG. 8 to show a first frame and the cam gear with the relative positions thereof;
FIG. 12 is a side view taken along arrow B of FIG. 8 to show the first frame, a first arm, and a supporting arm with the relative positions thereof;
FIG. 13 is a front view showing the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the second position;
FIG. 14 is a side view partially in section showing the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the second position;
FIG. 15 is a perspective view showing the electronic instrument of FIG. 1, in which the first holder and the second holder have moved to the second position;
FIG. 16 is a side view taken along arrow C of FIG. 15 to show the second frame and the cam gear with the relative positions thereof;
FIG. 17 is a side view taken along arrow C of FIG. 15 to show the second frame, the second arm, and the third arm with the relative positions thereof;
FIG. 18 is a side view taken along arrow D of FIG. 15 to show the first frame and the cam gear with the relative positions thereof;
FIG. 19 is a side view taken along arrow D of FIG. 8 to show the first frame, a first arm, and a supporting arm with the relative positions thereof;
FIG. 20 is a front view of the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the third position;
FIG. 21 is a side view partially in section showing the electronic instrument of FIG. 1, in which the first operation unit and the second operation unit have moved to the third position;
FIG. 22 is a perspective view showing the electronic instrument of FIG. 1, in which the first holder and the second holder have moved to the third position;
FIG. 23 is a side view taken along arrow E of FIG. 22 to show the second frame and the cam gear with the relative positions thereof;
FIG. 24 is a side view taken along arrow E of FIG. 22 to show the second frame, the second arm, and the third arm with the relative positions thereof;
FIG. 25 is a side view taken along arrow F of FIG. 22 to show the first frame and the cam gear with the relative positions thereof;
FIG. 26 is a side view taken along arrow F of FIG. 22 to show the first frame, the first arm, and the supporting arm with the relative positions thereof;
FIG. 27 is a side view partially in section showing

first frame 57 in the side of the front panel 15.

[0049] The pair of second frames 35 each of which is a flat metal plate are spaced from each other in a lateral direction the electronic instrument 1. Each first frame 57 is raised from the bottom wall of the chassis body 14 to be secured to the chassis body 14.

[0050] As illustrated in FIG. 4, each second frame 35 is positioned outside the cam gear 23 within the instrument body 2 in a lateral direction of the instrument body 2. Thus, the first frame 57 is opposed to the other face 23a of the cam gear 23.

[0051] As illustrated in FIGS. 4, 5, and 9, the second frame 35 has a pair of second guide holes 41 and a third guide hole 42. The second frame 35 further has supporting pins 38a and 38b. The second guides hole 41 and the third guide hole 42 penetrate the second frame 35. As illustrated in FIG. 9, the second guide hole 41 extends generally inward within the instrument body 2 from an end positioned at a side of the front panel 15 to the other end thereof.

[0052] As illustrated in FIG. 9, each second guide hole 41 has a horizontal segment 51, an arc segment 52, and a vertical portion 53 which are sequentially positioned along a direction from an inner side of the instrument body 2 toward a side of the front panel 15. The horizontal segment 51 is extended horizontally, and the arc segment 52 is contiguous with the horizontal segment 51. The arc segment 52 is an arc in a plain. The vertical portion 53 is contiguous with the arc segment 52 to extend from the arc segment 52 downward.

[0053] The third guide hole 42 is an arc having a curvature center at the supporting pin 38a. The supporting pin 38a is positioned at a side end portion of the second frame 35 in the side of the front panel 15. The supporting pin 38a is projected from the second frame 35 to extend in a lateral direction of the instrument body 2 outward within the chassis body 14.

[0054] As illustrated in FIG. 5, the supporting pin 38b is projected from the second frame 35 to extend in a lateral direction of the instrument body 2 inward within the chassis body 14. The supporting pin 38b is inserted into the cam gear 23 at the rotating center Q of the cam gear 23 to turnably support the cam gear 23.

[0055] As illustrated in FIGS. 1 to 6, 13, and 20, the instrument body 2 has a housing 8 which is a flat box having a short height, a liquid crystal display 9 (referred to as LCD hereinafter) which is a display panel received in the housing 8, and some types of switches. The housing 8 has a breadth and a height generally the same as those of the chassis 5.

[0056] The LCD 9 has an area to display various kinds of information for the user. Switches 10 constitute an operation section for the user. The display area and the operation section are located on an face 8a of a front side of the housing 8 as illustrated in FIG. 1. The face 8a is exposed outward so that the exposed face 8a is referred to as an exposed surface hereinafter.

[0057] The user operates the switch 10 positioned on the second operation unit 3, e.g. to select a broadcasting station to receive associated radio waves by the AM/FM tuner. At the same time, the LCD 9 of the second operation unit 3 displays information such as a selected wave frequency and an associated broad station.

[0058] The second operation unit 3 is removably attached to a second holder 39 (FIGS. 4 and 5) discussed later of the driving mechanism 6.

[0059] In the illustrated example, at each side end of the rear face opposed to the exposed face 8a of the second operation unit 3, there is provided a groove (not shown). The groove engages with a locking hook 26 (FIG. 8) formed on the second holder 39. The engagement of the groove with the locking hook 26 fully receives the second operation unit 3 in the second holder 39. The disengagement of the locking hook 26 from the groove removes the second operation unit 3 from the second holder 39.

[0060] As illustrated in FIGS. 3 to 5 and 20, the first operation unit 4 has a housing 11 which is a flat box having a short height, a liquid crystal display 12 (referred to as LCD hereinafter) which is a display panel received in the housing 11, and some types of switches 13. The housing 11 has a breadth and a height which are respectively slightly smaller than the inside dimensions of the vertical wall 15c of the chassis 5 of the instrument body 2.

[0061] The LCD 12 has an display area to display various kinds of information for the user. The switches 13 constitute an operation section for the user. The display area and the operation section are located on a face 11a of a front side of the housing 11 as illustrated in FIG. 20. The face 11a is exposed outside so that the exposed face 11a is referred to as an exposed surface hereinafter.

[0062] For example, the operation of the switches 13 on the first operation unit 4 by the user can select a piece of music to be reproduced by the CD player, and the LCD 12 of the first operation unit 4 displays information such as a track number of the selected music on the LCD 12.

[0063] The second operation unit 3 and the first operation unit 4 are moved by the driving mechanism 6 to the first position of FIG. 1, the second position of FIG. 2, and the third position of FIG. 3. In this embodiment, the driving mechanism 6 moves the second operation unit 3 and the first operation unit 4 sequentially to the first to third positions. The driving mechanism 6 also moves the second operation unit 3 and the first operation unit 4 sequentially to the third to first positions.

[0064] At the first position, the exposed faces 8a and 11a of the second operation unit 3 and the first operation unit 4 are positioned parallel to and spaced from each other in a direction perpendicular to the surface 15a of the front panel 15. The first operation unit 4 is positioned between the second operation unit 3 and the front surface 15a. The first operation unit 4 is received in a space surrounded by the vertical walls 15c and the front sur-

sion gear 22.

[0078] The turning central axes of the gears 21, 22. and 23 are oriented respectively along a lateral direction of the instrument body 2 of FIG. 1, while each face of the gears 21, 22, and 23 is parallel to a longitudinal direction the instrument body 2 of FIG. 1.

[0079] The cam gear 23 is formed with a first groove 23c in one face 23b facing laterally inward in the chassis body 14 of the instrument body 2 as illustrated in FIG. 11. The first groove 23c has a cam groove 33 and a cam groove 34 which are defined in the face 23b.

[0080] As illustrated in FIG. 11, the cam groove 33 extends in a generally radial direction of the cam gear 23 to a side near the turning center Q of the cam gear 23. The cam groove 33 is slightly curved to define an arc having a radius center at the turning center Q.

[0081] As illustrated in FIG. 11, the cam groove 34 has an arc segment 34a having a radius center at the turning center Q of the cam gear 23 and a spiral portion 34b contiguous with the arc segment 34a. The arc segment 34a is positioned near a periphery of the cam gear 23. The spiral portion 34b extends to come gradually near the turning center Q of the cam gear 23 from the arc segment 34a.

[0082] The cam gear 23 is formed with a second groove 31 and a third groove 32 in the other face 23a facing laterally outward in the chassis body 14 of the instrument body 2 as illustrated in FIG. 9.

[0083] As illustrated in FIG. 9, the second groove 31 and the third groove 32 respectively extend spirally around the turning center Q of the cam gear 23. The second groove 31 and the third groove 32 are generally symmetrical relative to the turning center Q of the cam gear 23 in position and shape thereof. The second groove 31 and the third groove 32 respectively extend spirally to come gradually near a periphery of the cam gear 23 from its inner end positioned in the side of the turning center Q.

[0084] In the primary driving unit 16 described above, the rotational driving force of the motor 19 turns the cam gear 23 counterclockwise along arrow L of FIG. 9 and clockwise along arrow M of FIG. 16.

[0085] As illustrated in FIG. 4, the first drive section 18 has a first arm 58 as a first turnable supporting member, a supporting arm 59 as a supporting member, the first guide hole 57a, and the supporting hole 45.

[0086] The first arm 58 is positioned along a lateral direction of the instrument body 2 inside the first frame 57 within the chassis body 14. The first arm 58 has an arm portion 60 extended inward from a side of the front panel 15 of the instrument body 2. The first arm 58 further has a vertical portion 61 extended vertically.

[0087] The arm portion 60 has an end supporting an lower end of the first holder 40 at a side of the front panel 15. The arm portion 60 supports the lower end of the first holder 40 turnably around a turning axis R (shown by a chain line in FIG. 4) directed in a lateral direction of the electronic instrument 1. The vertical portion 61 is contiguous with the other end of the arm portion 60 to rise upward therefrom.

[0088] The first arm 58 has two first driving pins 62 as the first projecting piece respectively at each end of the vertical portion 61. The first driving pins 62 are projected from the first arm 58 outward laterally in the chassis body 14 of the instrument body 2. The first driving pins 62 each are projected toward the first groove 23c formed on the one face 23b of the cam gear 23.

[0089] The first driving pins 62 extend respectively through the hole 43 or 44 of the first guide hole 57a when assembled with the first arm 58 which is positioned inside the first frame 57 within the chassis body 14. Furthermore, the first driving pins 62 are respectively received in the cam groove 33 or the cam groove 34 of the cam gear 23. The upper first driving pin 62 is extended through the hole 43 of the first guide hole 57a, so that the first arm 58 is supported by the arc segment 46 turnably around a turning center T (shown by a chain line in FIGS. 4, 5. 8, 15, and 22). Thus, the first arm 58 is turnably supported by the first frame 57, i. e. by the chassis 5.

[0090] The supporting arm 59 is unitarily formed with the first holder 40 and has a side surface of an arc shape extending in a longitudinal direction of the electronic instrument 1. The supporting arm 59 extends from an upper end of the first holder 40 at each side end of the first holder 40 inward in the instrument body 2. That is, the supporting arm 59 extends from the first holder 40 constituting the first operation unit into the instrument body 2. The supporting arm 59 is positioned laterally inside the first frame 57 within the chassis body 14.

[0091] The supporting arm 59 has a supporting pin 63 at its end 59a distal from the first holder 40. The supporting pin 63 is projected from the supporting arm 59 to extend outward in the chassis body 14 along a lateral direction of the instrument body 2. The supporting pin 63 is received in the supporting hole 45 when the supporting arm 59 is positioned inside the first arm 58 in the chassis body 14. That is, the end 59a of the supporting arm 59 is received in the supporting hole 45 which is a guide channel.

[0092] The first groove 23c, the first driving pin 62, and the first frame 57 correspond to,the first drive device described in the summary of the invention. The first arm 58 is supported by the first frame 57, i. e. by the chassis 5 turnably around the turning center T.

[0093] As illustrated in FIG. 4, the second drive section 17 has a second arm 36 as a second supporting member, a third arm 37 as a second turnable supporting member, a second guide hole 41, and a third guide hole 42.

[0094] As illustrated in FIGS. 4 and 10, the locking hook 26 extends inward from a side of the front panel 15 of the instrument body 2 into the chassis body 14. The second arm 36 is laterally positioned outward from the second frame 35 within the chassis body 14.

[0095] The second arm 36 has an end positioned in

[0108] The link rod 64 is supported by the chassis body 14 turnably around a central axis of the link rod 64. The link rod 64 includes a rod body 65 and a link gear 66 provided at each end of the rod body 65. The central axis of the link rod 64 is oriented along a lateral direction of the electronic instrument 1. The link gears 66 engage respectively with the cam gear 23 of the first driving unit 24 or the cam gear 23 of the second driving unit 25. Thus, the rotation of the motor 19 of the first driving unit 24 turns the cam gear 23 of the first driving unit 24 and the cam gear 23 of the second driving unit 25.

[0109] Next, an operation of the driving mechanism 6 having the aforementioned configuration will be discussed. As illustrated in FIGS. 9 and 10, at the first position, the two second driving pins 54 of the second arm 36 are respectively located at an inner end of the associated horizontal segment 51 of the second guide hole 41 of the second frame 35 within the instrument body 2. The second driving pin 54 formed at the middle of the second arm 36 is located at an end of the second groove 31 which is in the side of the turning center Q of the cam gear 23.

[0110] The third driving pin 56 of the third arm 37 is located at a lower end of the third guide hole 42 of the second frame 35. The third driving pin 56 is located at an end of the third groove 32 which is in the side of the rotating center Q of the cam gear 23.

[0111] As illustrated in FIG. 11 and 12, at the first position, the first driving pin 62 (referred to as an upper first pin) provided at an upper end of the vertical portion 61 of the first arm 58 is located at an inner end of the arc segment 46 of the hole 43 of the first frame 57 within the instrument body 2. The upper first driving pin 62 is also located at an inner end of the cam groove 33 of the cam gear 23 within the instrument body 2.

[0112] The first driving pin 62 (referred to as a lower first pin hereinafter) provided at a lower end of the vertical portion 61 of the first arm 58 is located at an inner end of the arc segment 34a of cam groove 34 which is in a distal side of the spiral portion 34b. The lower first driving pin 62 is also located in the hole 44. The supporting pin 63 of the supporting arm 59 is located at an upper end of the first vertical segment 48 of the first frame 57.

[0113] Thus, as illustrated in FIGS. 6 and 7, the exposed faces 8a and 11a of the second operation unit 3 and the first operation unit 4 are disposed parallel to the surface 15a of the front panel 15. The exposed face 11a is positioned between the second operation unit 3 and the front panel 15. That is, the first operation unit 4 is covered by the front panel 15 and the second operation unit 3. The recording medium inserting slot 7 is closed by the second operation unit 3 and the first operation unit 4. As illustrated in FIG. 8, the second holder 39 and the first holder 40 are aligned with each other in a direction shown by arrow Z, and the second holder 39 is positioned in a forward side of the first holder 40.

[0114] The normal rotation of the motor 19 turns the cam gear 23 along arrow L shown in FIGS. 9 and 11, so that the second driving pin 54 moves to a peripheral portion of the cam gear 23. Because, the second groove 31 is spiral so as to gradually come close to the peripheral portion and to gradually come away from the rotating center Q of the cam gear 23.

[0115] At the same time, the second driving pin 54 moves along horizontal segment 51 of the second guide hole 41 toward the user, and then the second driving pin 54 moves downward along the arc segment 52. The second arm 36 moves along a direction for ejecting the CD from the recording medium inserting slot 7 to gradually come away from the third arm 37.

[0116] Furthermore, the third driving pin 56 moves to a peripheral portion of the cam gear 23. Because, the third groove 32 is spiral so as to gradually come close to the peripheral portion and to gradually come away from the rotating center Q of the cam gear 23. At the same time, the third driving pin 56 moves upward along the third guide hole 42, and then the third arm 37 turns along arrow N of FIG. 10.

[0117] Thus, the second holder 39, i. e. the second operation unit 3 moves in a direction perpendicular to the surface 15a of the front panel 15 to come away from the instrument body 2, and then the second operation unit 3 moves downward from the instrument body 2. Then, the second arm 36 moves gradually apart from the third arm 37, and the third arm 37 turns along arrow N of FIG. 10 so that the exposed face 8a turns around the turning axis P to face upward.

[0118] At the first position, the normal rotation of the motor 19 turns the cam gear 23 along arrow L shown in FIGS. 9 and 11, so that the first driving pin 62 moves along the arc segment 46 around the first driving pin 62 to reach an end of the arc segment 46 located in the side of the front panel 15, while the first driving pin 62 is positioned at a lower end of the hole 44. Because, the lower first driving pin 62 of the first arm 58 is positioned in the arc segment 34a of the cam groove 34, and the upper first driving pin 62 is positioned in the arc segment 46 of the hole 43.

[0119] Thus, the first arm 58 turns around the rotating center T along arrow O (FIG. 12). The first holder 40, i. e. the first operation unit 4 moves downward relative to the length of the arc segment 46. At the same time, the supporting pin 63 of the supporting arm 59 moves downward along the first vertical segment 48. That is, the supporting pin 63 of the supporting arm 59 moves along the supporting hole 45.

[0120] Thus, the second operation unit 3 and the second holder 39 move from the first position in a direction perpendicular to the surface 15a of the front panel 15 to come away from the instrument body 2, and then the second operation unit 3 slides downward from the instrument body 2, so that the exposed face 8a turns a little to face upward as illustrated in FIGS. 13 and 14. The first operation unit 4 moves downward to expose the recording medium inserting slot 7 as illustrated in

of the hole 43 formed in the first frame 57. The lower first driving pin 62 is positioned at an end of the spiral portion 34b of the cam groove 34 in the side of the rotating center Q of the cam gear 23. The lower first driving pin 62 is positioned at an upper end of the hole 44. The supporting pin 63 of the supporting arm 59 is positioned in the first vertical segment 48 of the supporting hole 45 formed in the first frame 57.

[0137] Thus, as illustrated in FIGS. 20 and 21, the second operation unit 3 further moves downward from the second position, and the first operation unit 4 moves upward from the second position. The second operation unit 3 and the first operation unit 4 turns so that the exposed faces 8a and 11a are oriented upward. Thus, the exposed faces 8a and 11a are exposed to the user so that the user can see well the display surfaces of the LCDs 9 and 12.

[0138] As illustrated in FIG. 22, the second holder 39 further moves downward from the second position, and the first holder 40 moves upward from the second position, so that the second holder 39 is positioned lower than the first holder 40.

[0139] For the movement from the third position to the second position, a reverse rotation of the motor 19 turns the cam gear 23 along arrow M of FIGS. 16, 18, 23, and 25 which is a direction opposed to arrow L.

[0140] Thus, the second operation unit 3 and the first operation unit 4 each move relative to the instrument body 2 between the first position to cover the recording medium inserting slot 7 and the second position to expose the recording medium inserting slot 7. The second operation unit 3 and the first operation unit 4 can be moved relative to the instrument body 2 to reach the third position to expose the faces 8a and 11a for the user.

[0141] The second holder 39, i. e. the second operation unit 3 moves downward relative to the instrument body 2 from the first position to second position. Furthermore, the second operation unit 3 moves downward relative to the instrument body 2 from the second position to the third position.

[0142] The first holder 40, i. e. the first operation unit 4 moves downward relative to the instrument body 2 from the first position to the second position. Furthermore, the first operation unit 4 moves upward from the second position to the third position.

[0143] At the second and third positions, the second holder 39, i. e. the second operation unit 3 turns around the turning axis P laterally extending within the electronic instrument 1 so that the exposed face 8a faces upward. At the third position, the first holder 40, i. e. the first operation unit 4 turns around the turning axis R laterally extending within the electronic instrument 1 so that the exposed face 11a is oriented upward.

[0144] In the electronic instrument 1, the second operation unit 3 can be removed from the second holder 39 at the second position or at the third position. In the removed state, the reverse rotation of the motor 19 moves the second holder 39 toward the first position. The first operation unit 4 is positioned between the second holder 39 and the front panel 15, while the second holder 39 and the first operation unit 4 are aligned with each other in a direction perpendicular to the surface 15a of the front panel 15. Thus, when the second operation unit 3 is removed from the second holder 39, the second holder 39 and the front panel 15 cover the first operation unit 4, but the electronic instrument 1 itself is not ready to be used.

[0145] In the embodiment, for moving the first holder 40 and the first operation unit 4 between the first position and the second position, there are provided the supporting arm 59 extended toward the instrument body 2 unitarily from the first holder 40 and the first arm 58 turnably supported by the first frame 57. Furthermore, for moving the supporting arm 59 and the first arm 58, there are provided the supporting hole 45 and the first guide hole 57a.

[0146] Thus, the simple configurations of the supporting arm 59 unitarily formed with the first holder 40 and the first arm 58 can move the first holder 40 and the first operation unit 4. This prevents an increase in number of parts and in a manufacturing cost of the electronic instrument 1. The supporting arm 59 is unitary with the first holder 40 to move together.

[0147] The first groove 23c formed in the one face 23b of the cam gear 23 receives the first driving pin 62 protruded from the first arm 58 through the first guide hole 57a. The turning of the cam gear 23 moves the first driving pin 62 along the first guide hole 57a, so that the first holder 40 and the first operation unit 4 surely move between the first position and the second position.

[0148] When the second holder 39 and the second operation unit 3 move from the first position to the second position, the second arm 36 moves along the ejecting direction of the CD of the recording medium so that the second arm 36 comes apart from the third arm 37 and the third arm 37 is turned. Thus, when the second holder 39 and the second operation unit 3 move from the first position to the second position, the second holder 39 and the second operation unit 3 incline in a direction to cause the second arm 36 to come close to the third arm 37, i. e. upward in the illustrated example.

[0149] Therefore, at the second position, the exposed face 8a of the second operation unit 3 is easily exposed to the user, so that the LCD 9 provided on the exposed face 8a can surely display information so as to be surely visually recognized by the user. That is, the user can reliably visually recognize an operation status of the electronic instrument 1 through the display of the LCD 9.

[0150] The second groove 31 formed in the other face 23a of the cam gear 23 receives the second driving pin 54 of the second arm 36 through the second guide hole 41, while the third groove 32 receives the third driving pin 56 of the third arm 37 through the third guide hole 42.

[0151] The turning of the cam gear 23 moves the second driving pin 54 along the second guide hole 41 and

wherein the gear turns so that the first groove moves the first projecting piece along the first guide hole to move the first operation unit between the first position and the second position.

4. A driving mechanism of an electronic instrument having an instrument body formed with a recording medium inserting slot for inserting a recording medium into the instrument body, the driving mechanism moving a second operation unit between a first position for covering the recording medium inserting slot and a second position for exposing the recording medium inserting slot, the driving mechanism comprising:

a second supporting member for supporting the second operation unit,
a second turnable supporting member turnably fitted to the instrument body for supporting the second operation unit, and
a second drive device for turning the second turnable supporting member, the second drive device supporting the second supporting member movably in directions along which the recording medium is inserted and removed,

wherein the second drive device moves the second supporting member and turns the second turnable supporting member to move the second operation unit between the first position and the second position.

5. The driving mechanism according to claim 4 wherein the second drive device include:

a second projecting piece projecting from the second supporting member,
a third projecting piece projecting from the second turnable supporting member,
a gear turned by a drive motor, the gear formed with a second groove and a third groove,
a second guide hole through which the second projecting piece passes such that the second projecting piece is received in the second groove, and
a third guide hole through which the third projecting piece passes such that the third projecting piece is received in the third groove,

wherein the gear turns so that the second groove moves the second projecting piece along the second guide hole and the third groove moves the third projecting piece along the third guide hole to move the second operation unit between the first position and the second position.

6. A driving mechanism of an electronic instrument having an instrument body formed with a recording medium inserting slot for inserting a recording medium into the instrument body, the driving mechanism moving a first operation unit and a second operation unit between a first position for covering the recording medium inserting slot and a second position for exposing the recording medium inserting slot, the driving mechanism comprising:

a first turnable supporting member turnably fitted to the instrument body for supporting the first operation unit,
a first drive device for turning the first turnable supporting member,
a second supporting member for supporting the second operation unit,
a second turnable supporting member turnably fitted to the instrument body for supporting the second operation unit, and
a second drive device for turning the second turnable supporting member, the second drive device supporting the second supporting member movably in directions along which the recording medium is inserted and removed through the recording medium inserting slot of the instrument body,

wherein the first drive device turns the first turnable supporting member to move the first operation unit between the first position and the second position, and the second drive device moves the second supporting member and turns the second turnable supporting member to move the second operation unit between the first position and the second position.

7. The driving mechanism according to claim 6 wherein the first drive device includes:

a first projecting piece projecting from the first turnable supporting member,
a gear turned by a drive motor, the gear having a face formed with a first groove, and
a first guide hole through which the first projecting piece passes such that the first projecting piece is received in the first groove,
and the second drive device includes:

a second projecting piece projecting from the second supporting member,
a third projecting piece -projecting from the second turnable supporting member,
a second groove and a third groove which are formed in another face of the gear,
a second guide hole through which the second projecting piece passes such that the second projecting piece is received in the second groove, and
a third guide hole through which the third

FIG. 1

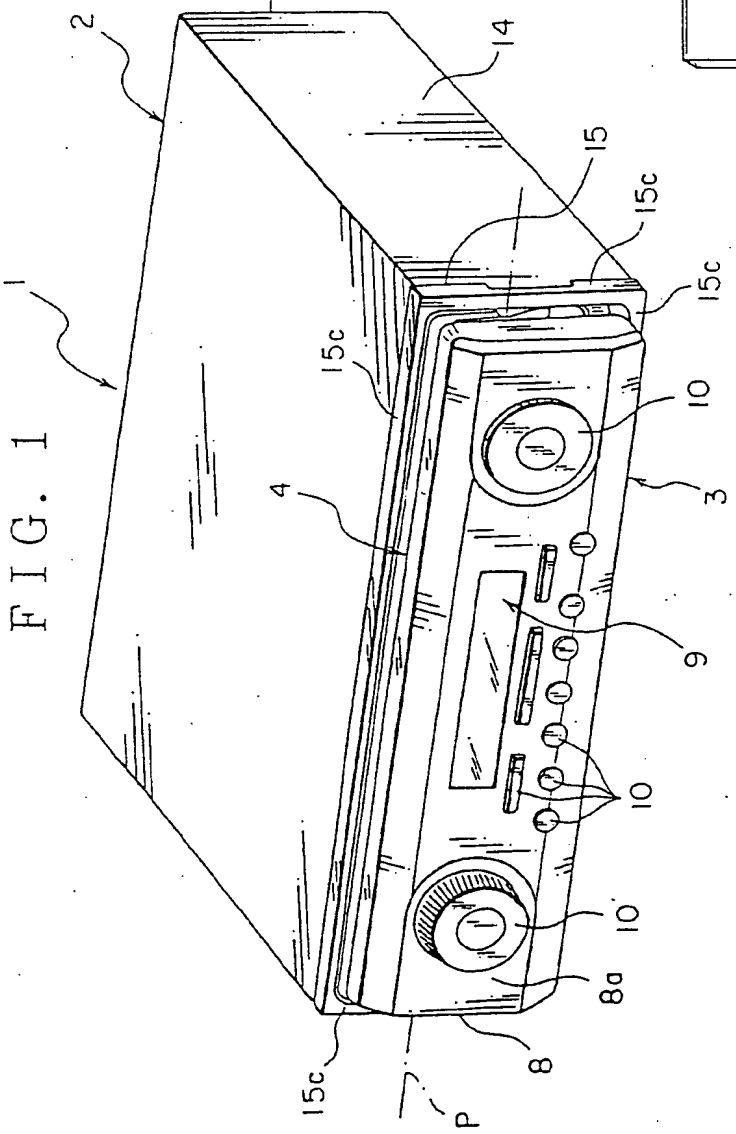
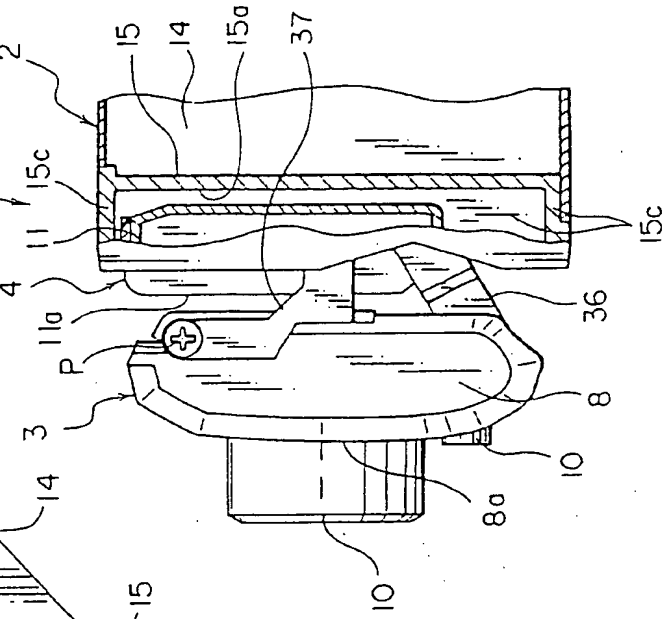


FIG. 7



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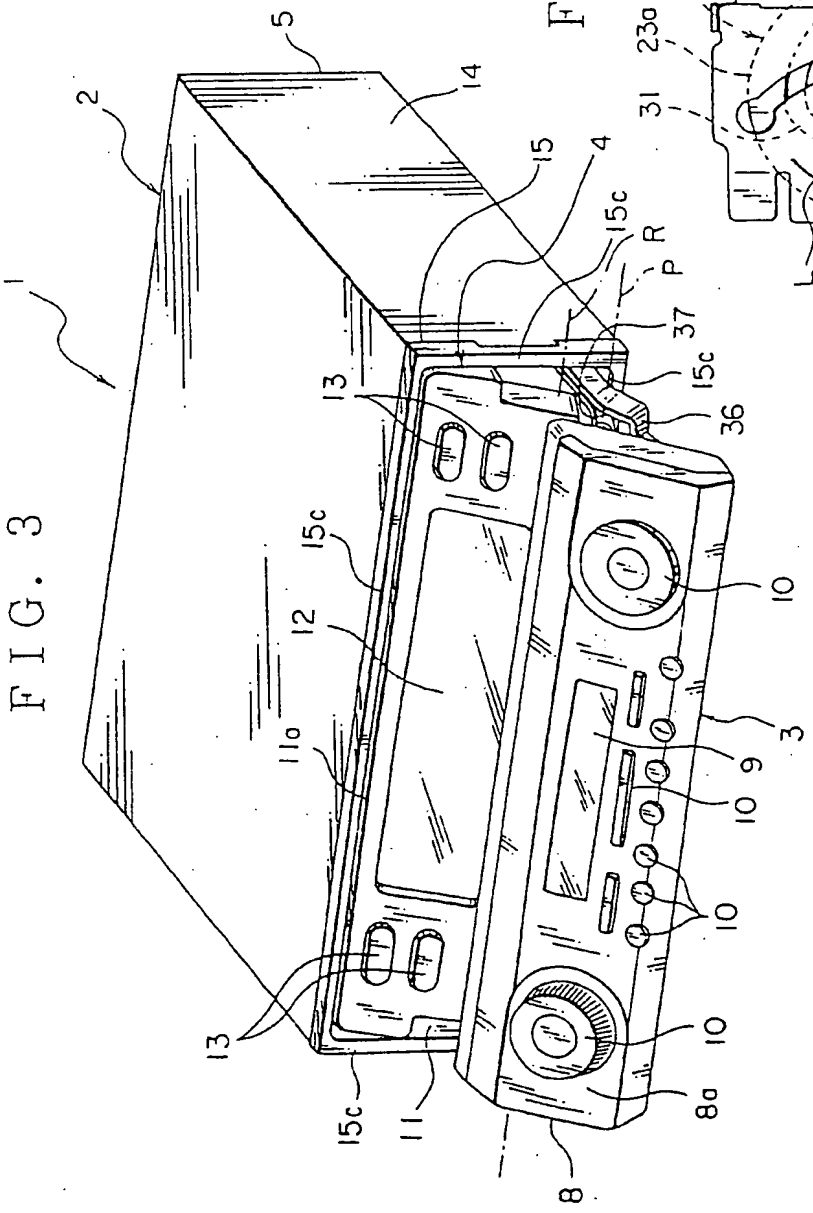
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15c
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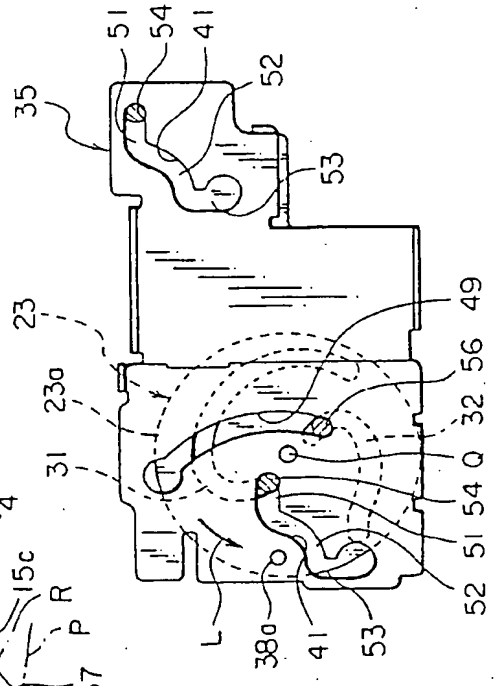
FIG. 9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23a
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FIG. 5

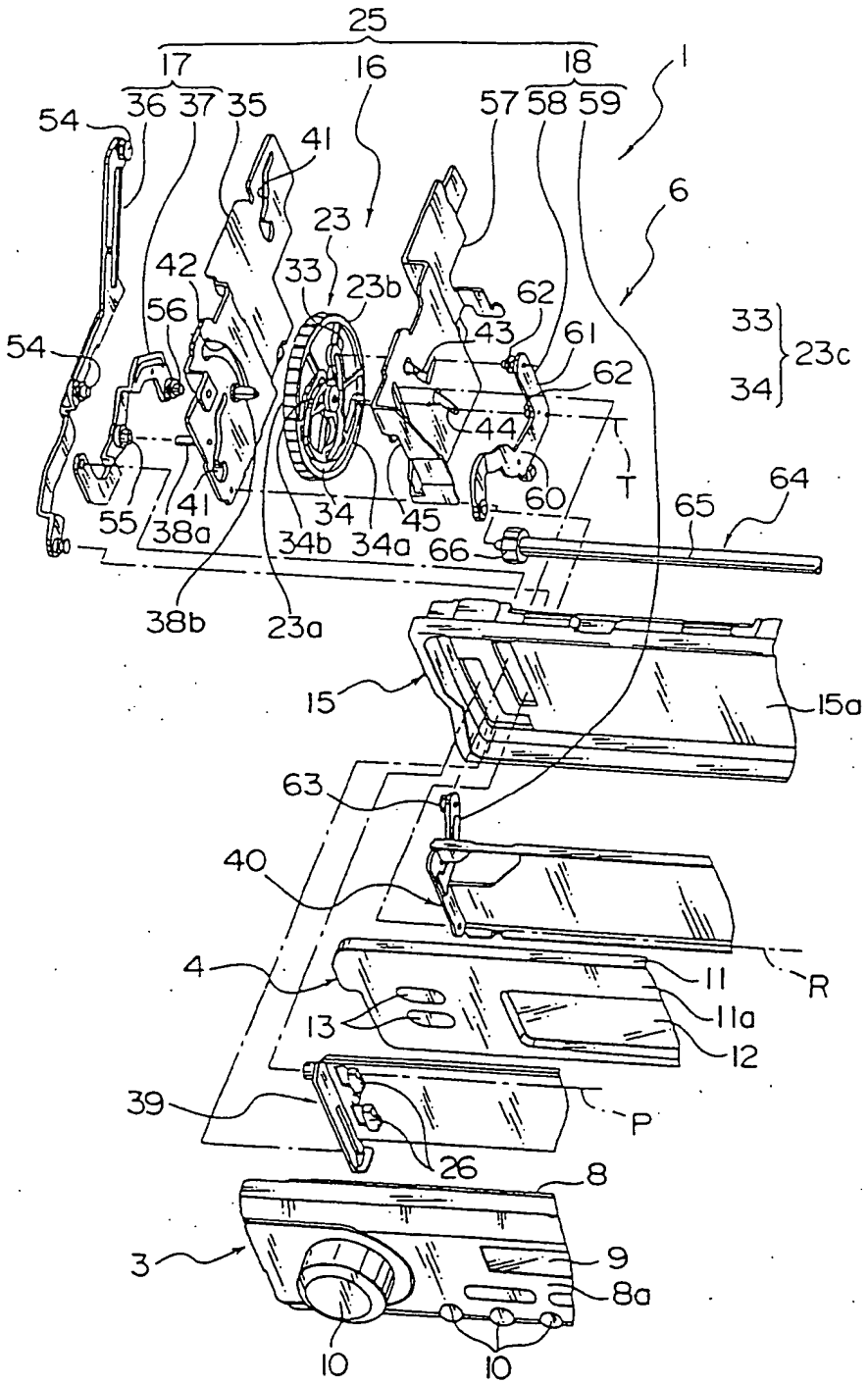

FIG. 10

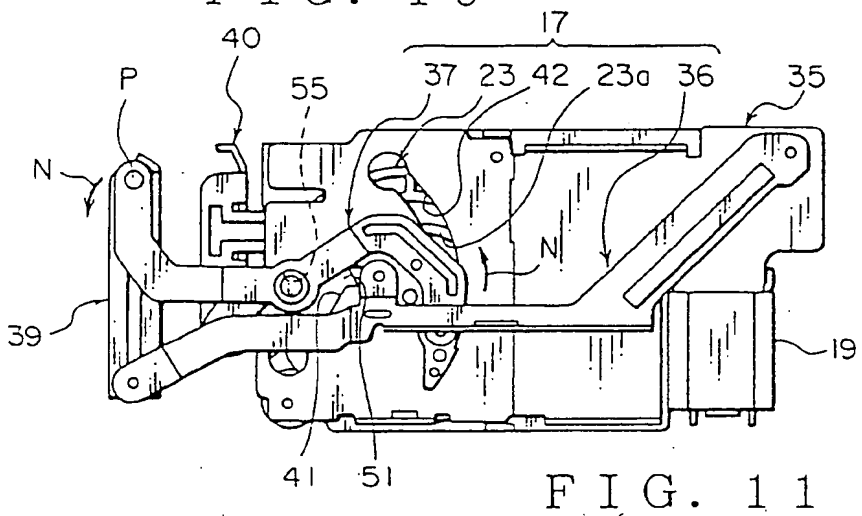

FIG. 11

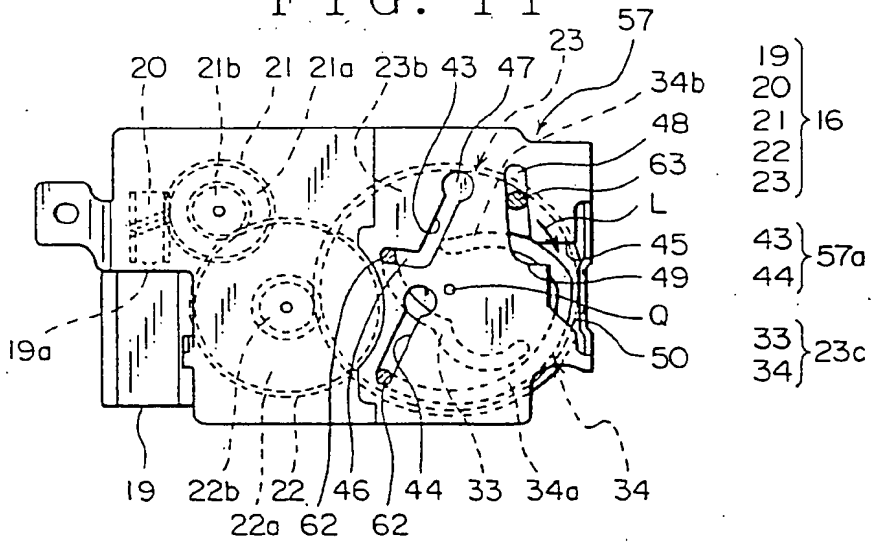

FIG. 12

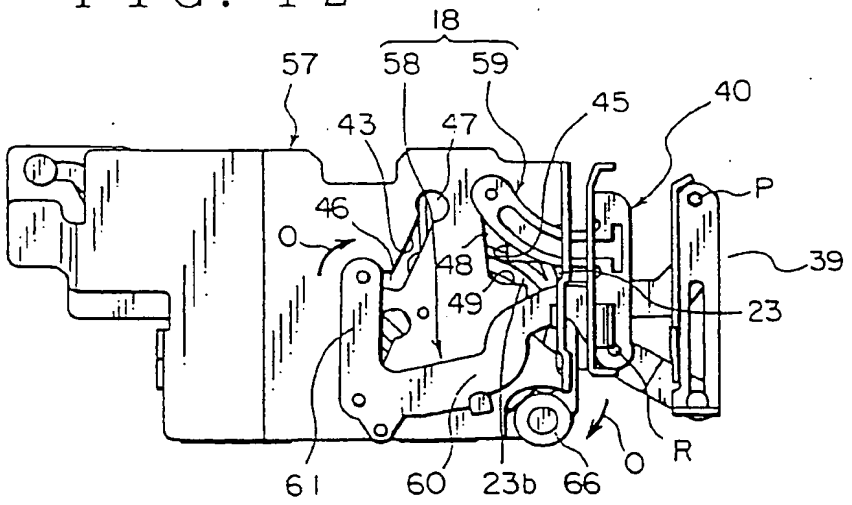

FIG. 15

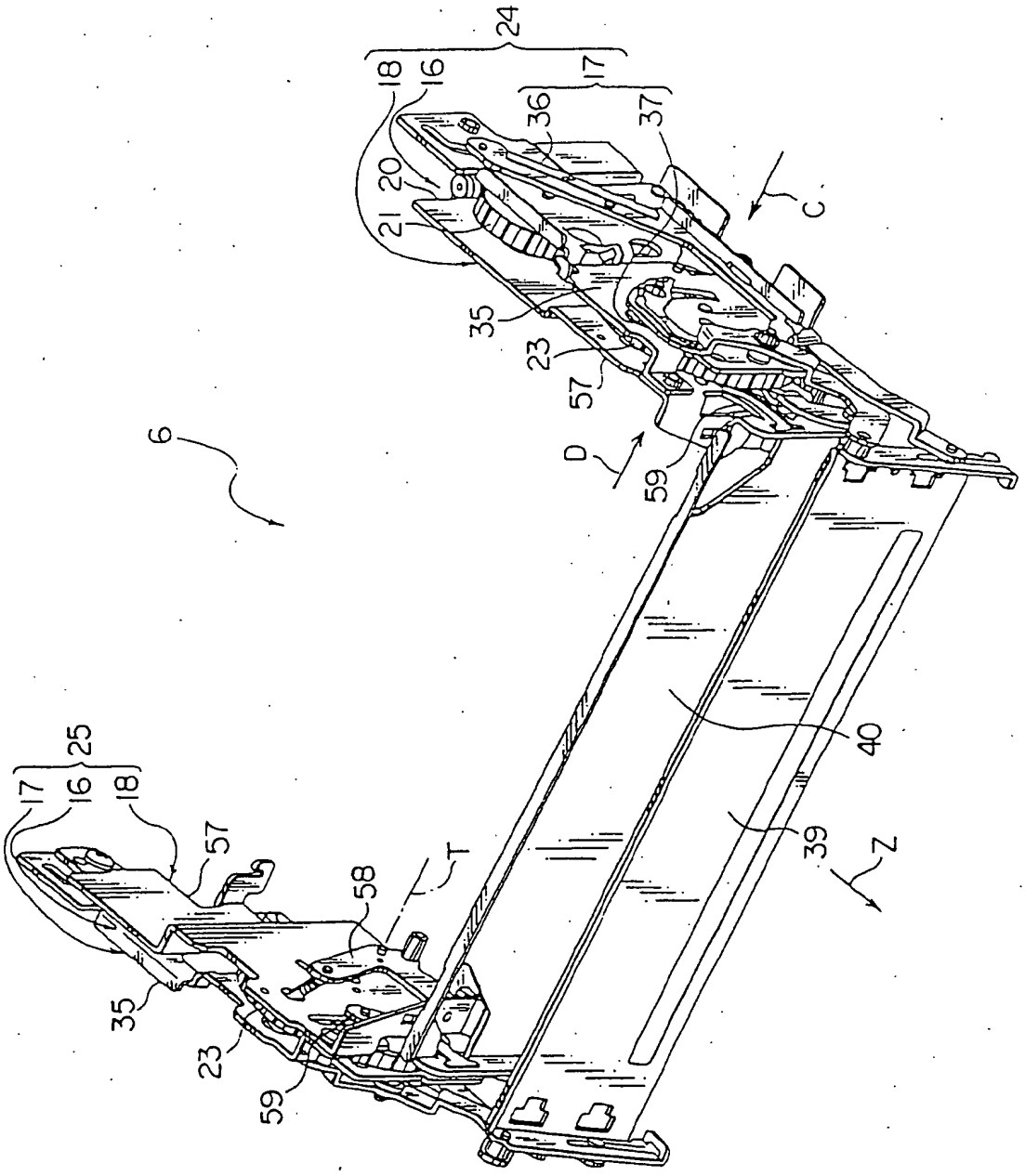

FIG. 21

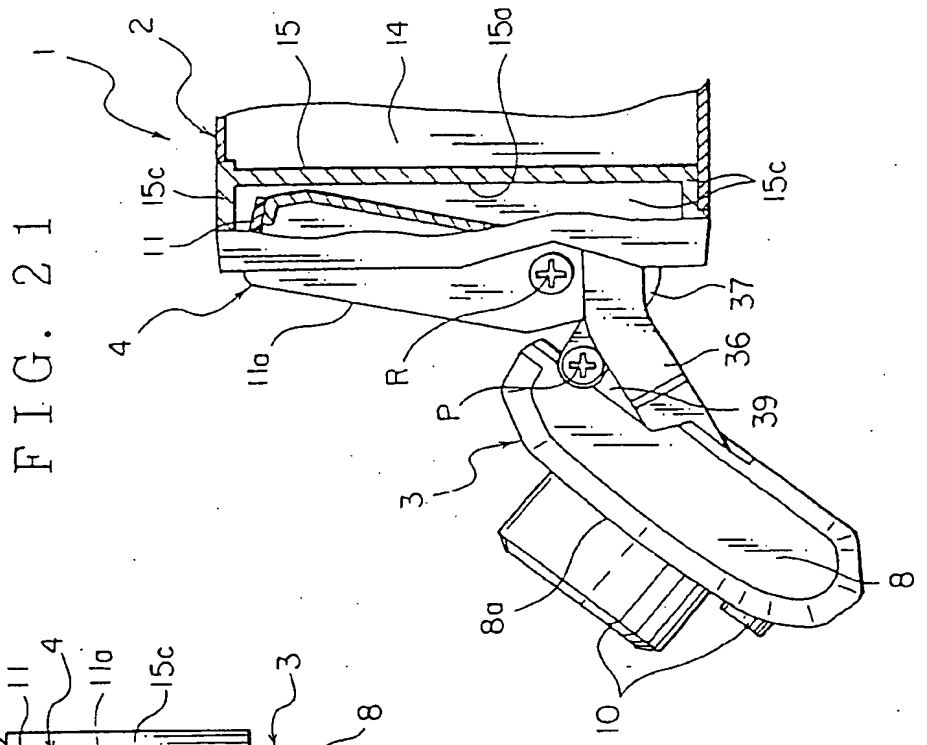

FIG. 20

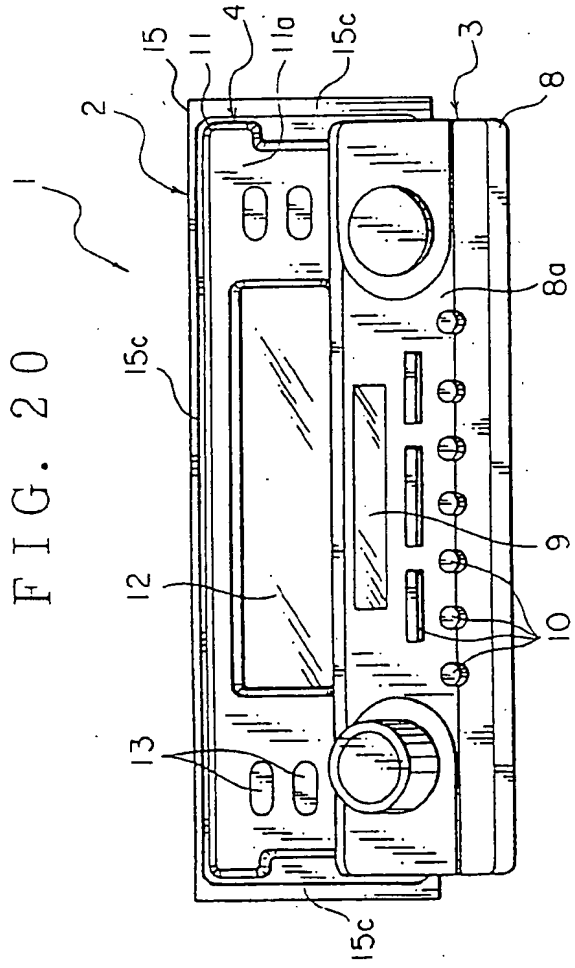

FIG. 23

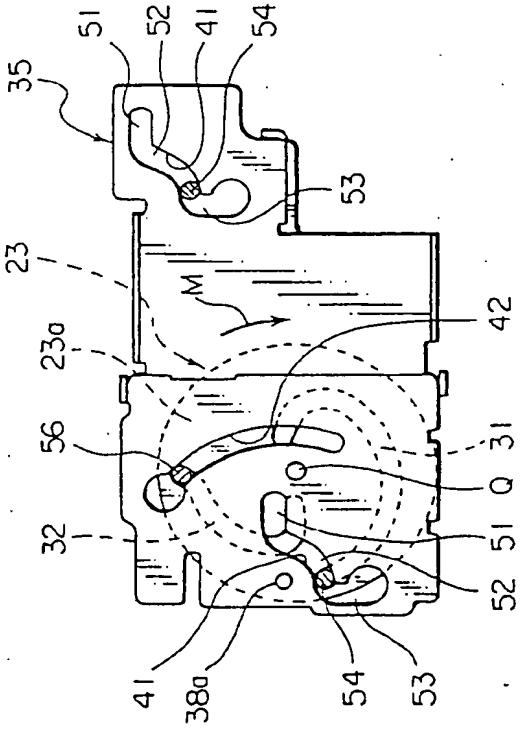

FIG. 24

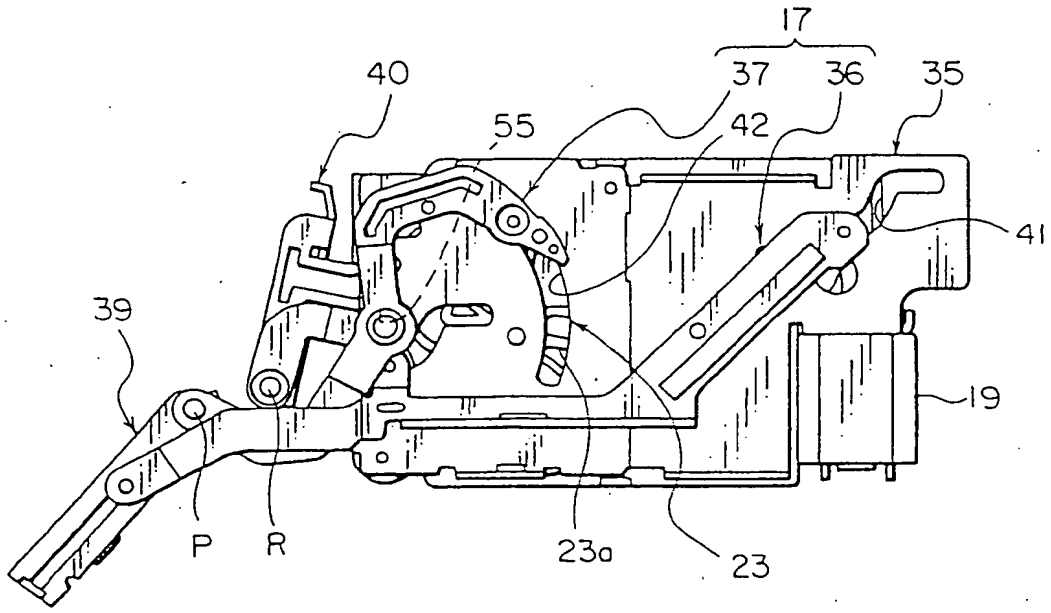

FIG. 25

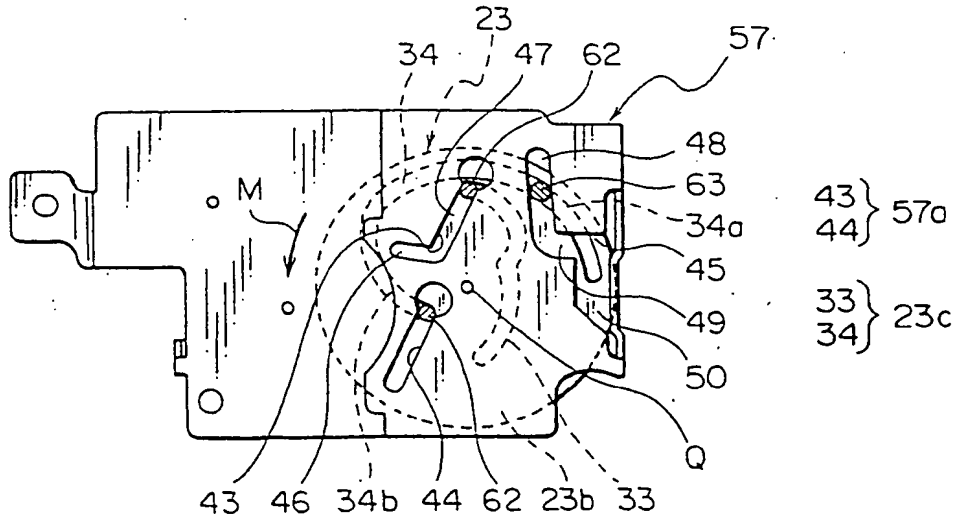

FIG. 28

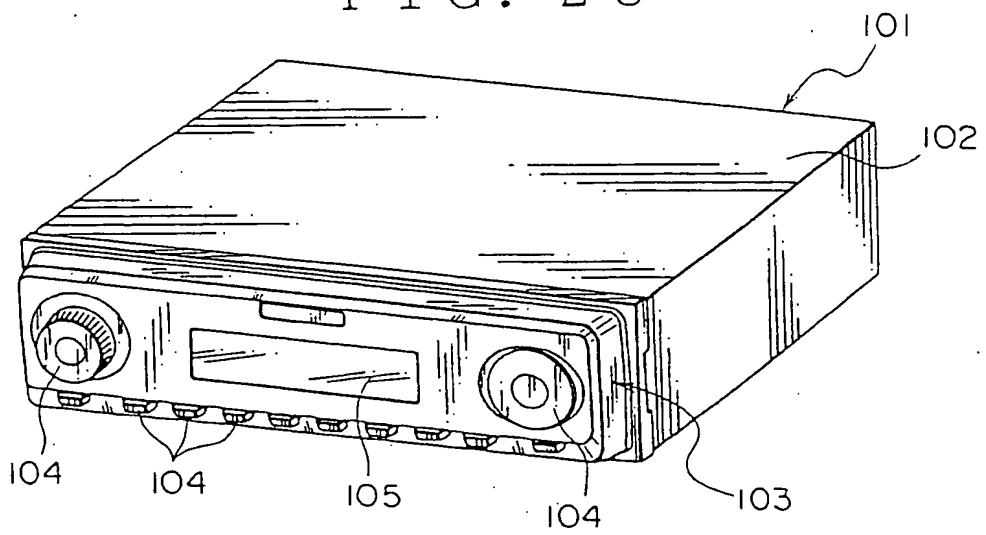
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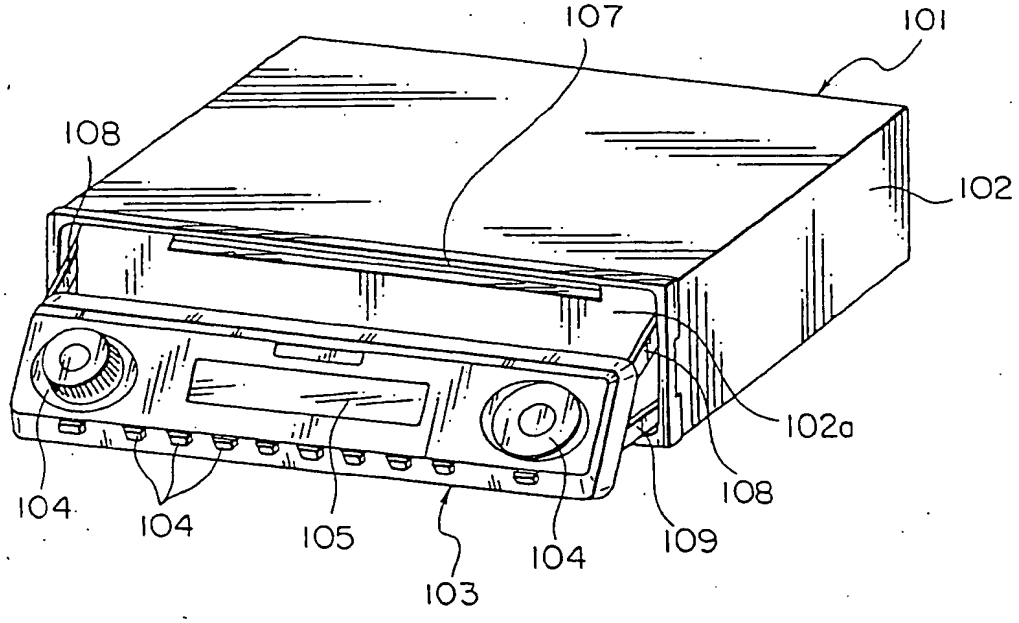
FIG. 29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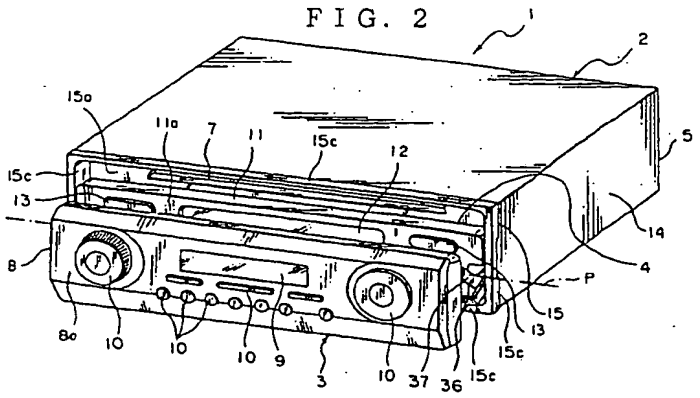
(54) **Driving mechanism of electronic instrument**

(57) The electronic instrument has an instrument body (2) formed with a recording medium inserting slot (7) for inserting a recording medium into the instrument body (2). The driving mechanism moves a first operation unit (4) and a second operation unit (3) between a first position for covering the recording medium inserting slot (7) and a second position for exposing the recording medium inserting slot (7). The driving mechanism includes a first turnable supporting member turnably fitted to the instrument body (2) for supporting the first operation unit (4), a first drive device for turning the first turnable supporting member, a second supporting member (36) for supporting the second operation unit (3), a second turnable supporting member (37) turnably fitted to the instrument body for supporting the second operation unit (3), and a second drive device for turning the second turnable supporting member. The second drive device supports the second supporting member movably in directions along which the recording medium is inserted and removed through the recording medium inserting slot (7) of the instrument body (2). The first drive device turns the first turnable supporting member to move the first operation unit between the first position and the second position. The second drive device moves the second supporting member and turns the second turnable supporting member to move the second operation unit between the first position and the second position.

FIG. 2



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